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XXVI.

NOTES ON ARCTIC ALGÆ; BASED PRINCIPALLY
ON COLLECTIONS MADE AT UNGAVA BAY BY
MR. L. M. TURNER.

BY W. G. FARLOW.

Communicated May 12, 1886.

IN 1883, Dr F. R. Kjellman communicated to the Swedish Royal Academy a monograph of "The Algæ of the Arctic Sea," which has since been issued as a separate publication. No botanist has ever had such advantages for acquiring a knowledge of Arctic Algæ as Dr. Kjellman, who accompanied Nordenskiöld in several of his voyages, and his admirable treatise must form the basis of any study of Arctic forms. Those interested in the literature relating to the Algæ of Greenland and the Arctic shores of the eastern coast of America will find a complete account in Dr. Kjellman's work. In the present connection, it is my object to give a summary of the species of marine algæ collected by American explorers in Arctic regions in recent years, especially those of a date subsequent to the completion of Dr. Kjellman's great work.

The largest of the collections was that made by Mr. L. M. Turner at Ungava Bay in 1884. It included a considerable number of mounted specimens, besides some rough-dried material, which was soaked out and mounted subsequently. This collection is especially interesting because it contains a number of species of *Florideæ* which are seldom seen in herbaria. Not only are the species themselves of great interest, but they are here represented, in several cases, by large sets of specimens, which enable one to estimate the amount of variation in specific characters. This is a point of considerable importance, for, except in rare cases, only a very small number of specimens of the less common *Florideæ* are to be found in Arctic collections.

I have also examined a second collection, made by Dr. Ludwig Kumlien, the botanist of the Howgate Polar Expedition in 1877-78, which includes some interesting *Phæosporeæ*. The algæ collected by

Dr. Kumlien were determined by me provisionally, and a rough list was printed in the Bulletin of the National Museum, No. 15 (Washington, 1879); but, not supposing that my list was to be published, the specific names were given without naming the authorities. In the following account, I have included a revision of the algæ collected by Dr. Kumlien, which were mostly found at localities comparatively near Ungava Bay. As they are of interest in studying the distribution, I have added occasional notes of some of the forms received from the coast of Alaska, collected by Mr. John Murdoch, the botanist of the expedition to Point Barrow, under Lieutenant Ray, and of some species from St. Paul's Island near Behring's Straits, for which I am indebted to Prof. D. C. Eaton.

FLORIDEÆ.

ODONTHALIA DENTATA, Lyngb.

Ungava Bay (Turner). A large number of specimens were collected, all of the broad form common on the northern shores of Europe. The narrow form of this species which, were it not for intermediary forms, might almost be considered a distinct species, is apparently more common in the Gulf of St. Lawrence than the type. The typical form was collected at Point Barrow, and was also found as far south as Victoria, British Columbia, by Mr. G. W. Lichtenhaler, one of whose specimens was unusually broad, being almost flabellate in shape. On the eastern coast this species is unknown south of Halifax, N. S.

POLYSIPHONIA ARCTICA, J. G. Agardh.

Ungava Bay (Turner). Annanactu Harbor, Gulf of Cumberland (Kumlien). A considerable number of specimens were collected, and, in all those examined, a section of the larger branches showed seven cells surrounding a central cell. The specimens from Annanactu Harbor grew on kelp at a depth of seven fathoms.

RHODOMELA LYCOPODIODES, J. G. Ag., var. *TENUISSIMA*, Kjellman.

Ungava Bay (Turner). Penny Harbor (Kumlien).

The typical form of this species as figured in the Phycologia Britannica, and represented in Areschoug's *Algæ Scandinavicæ Exsiccatae*, No. 3, is unknown to me on the American coast. Several specimens, which agree closely with a specimen of Ruprecht's *Fuscaria tenuissima*, which is considered by Kjellman a variety of *R. lycopodioides*, were collected both by Turner and Kumlien. A coarser

form, which I can with difficulty distinguish from some of the New England forms usually placed in *Rhodomela subfusca*, Ag., were found at Kikkerton Island by Kumlien.

DELESSERIA SINUOSA, Lamour.

Evidently as common in the Arctic Ocean as on the coasts of Europe and New England, and represented by a very large number of specimens collected by the present expedition.

DELESSERIA MONTAGNEI, Kjellman.

The present name was adopted by Kjellman in his *Algæ* of the Arctic Sea, in order to distinguish *Del. denticulata*, Montagne, from Harvey's species of the same name. A large number of specimens, which can be referred without doubt to *Del. denticulata*, Mont., were collected at Ungava Bay. They are sufficiently distinguished at sight from *Del. alata* by the serrated margin of the fronds. Besides, the lateral veins are with a lens generally easily seen in the broader parts of the fronds, thus agreeing with the description given by Kützing in the *Tabulæ Phycologicæ*. With regard to the relationship of the alga from Ungava Bay to *Del. spinulosa*, Rupr., a species found in the Pacific, I am unable to express any opinion, as in none of the North Pacific collections which I have examined is there any form resembling the present species.

DELESSERIA ALATA, Lamour.

A number of specimens which seem without doubt to belong to this species were collected at Ungava Bay. They resemble closely the broader form of the species found on the British coast. A few small specimens resembling rather the common narrow form of the New England coast than the type, were found on *Phlota serrata*, collected by Kumlien. *Delesseria angustissima*, Griff., a species certainly closely related to *Del. alata*, must be very rare on the American coast, if it occurs at all. A single specimen, collected several years ago at Cape Ann, by Mrs. Lusk, and referred by me to *Del. angustissima*, has cystocarpic fruit. Unfortunately the specimen was somewhat water-worn when collected, and, on that account, the determination is somewhat uncertain.

DELESSERIA BAERII, Rupr.

DELESSERIA CORYMBOSA, J. G. Ag.

The members of the subgenus *Cryptoneura* are, with one exception, very difficult to distinguish. This arises in part from the small

number of specimens of this group which are to be found in herbaria. An extraordinary number of specimens, not far from 150, were collected at Ungava Bay, and with this large amount of material it may be possible to obtain a better knowledge of the variations of the species of this group than has hitherto been possible. Some of the material was mounted, and the rest was kept rough-dried and soaked out by me for examination. The specimens furnished an abundance of tetraspores, and in some cases cystocarps. Some of them were from six to eight inches long, the fronds arising from a disk-like base as far as could be judged from the small number of specimens in which the base was present. In general the specimens could be arranged in two sets, although transitional forms were unfortunately frequent, and I am almost forced to believe that they are all forms of a single species, but what to call that species it is not easy to decide. In one set the main axis bears a number of long lateral branches, which are comparatively thin and compressed and more or less regularly zigzag, giving off the short secondary branches at the angles. The ultimate branches are short and distichously pinnate, becoming somewhat corymbose at the tip. There can be little doubt that the specimens just described should be placed in *Delesseria corymbosa*. The figure of that species in Kjellman, *loc. cit.*, Plate X. fig. 3, resembles closely the specimens from Ungava Bay, although the plant figured is somewhat smaller and narrower than ours.

The first set of specimens to which I have referred suggest in habit some of the forms of *Microcladia Coulteri*, Harv., of our west coast. The fronds of the specimens of the second set are less compressed, and the ultimate branches are more attenuated, so that, in some cases, they resemble somewhat forms of *Ceramium rubrum*. The arrangement of the cystocarps and tetraspores is the same in both sets of specimens. A small number of specimens similar to those now placed in the second set were collected on kelp in six fathoms, at Annanactu Harbor, by Kumlien, in October, 1877, and were referred by me to *Delesseria rostrata*, J. G. Ag. A specimen was afterwards examined by Professor Agardh, who thought that it was *Del. Baerii* rather than *Del. rostrata*. Certainly the Ungava Bay alga resembles the figure of *Del. Baerii* in Kützing's *Tabulæ Phycologicae*, drawn from a specimen in Herb. Sonder, and also a specimen from Nova Zembla collected by Kjellman. *Del. Baerii*, first described from the Arctic Pacific region, extends as far as Spitzbergen, but is not credited to Greenland or the eastern coast of America. *Del. rostrata*, Ag., based on Lyngbye's *Gigartina purpurascens*, var. *rostrata*, is a Green-

land form, and apparently Ruprecht doubts whether it is distinct from his *Del. Baerii*. By Agardh and Kjellman the two are kept distinct. Certainly one is not warranted in expressing a definite opinion from an examination of the figures of *Del. rostrata* in Lyngbye and the Flora Danica, for they are too imperfect to be recognized with certainty. On the whole, I am inclined to regard all the specimens from Ungava Bay as forms of a single species, because there are several specimens which connect the two sets already described. So far as they can be divided into two sets, I should consider them to belong in part to *Del. corymbosa*, and in part to *Del. Baerii*, on the grounds above stated, and the copious material from Ungava Bay warrants one in asking whether the two species in question are really distinct. A single specimen of what is here called *Del. Baerii* was found at Prince Edward's Island, in a collection received from Mrs. A. L. Davis.

DELESSERIA JÜRGENSII, J. G. Ag.

DELESSERIA CRASSIFOLIA, Rupr.

These two characteristic Algæ of the North Pacific were found in a collection from St. Paul's Island, Behring's Straits, received from Prof. D. C. Eaton.

RHODYMENIA PALMATA, Grev.

Ungava Bay (Turner 423 and 4870). Large specimens of the typical form. Although this species has been recorded in several works as occurring in the North Pacific, it is extremely doubtful whether such is the fact. All the Pacific specimens referred to this species which I have seen have proved, on microscopic examination, to belong to *Callophyllis*, or other genera than *Rhodymenia*.

RHODOPHYLLIS VEPRECUA, J. G. Ag. (*Fucus dichotomus*, Lepechin.)

Ungava Bay (Turner, 447, 765, 809, and 4872), Annanactu Harbor. On rocks at low tide, October, 1877, and Ovifak, Greenland, August, 1878 (Kumlien).

Typical forms. The broadest specimens which I have ever seen were collected on the coast of Massachusetts.

EUTHORA CRISTATA, J. G. Ag.

Ungava Bay (Turner). Annanactu Harbor, on rocks at low tide (Kumlien). Common as is this species on the New England coast, our Arctic collectors have brought home but few specimens. The single small specimen from Ungava Bay had cystocarpic fruit. Most

of the specimens of Kumlien belong to the narrow form, and grew at low-water mark. A specimen from forty fathoms is eight inches long, with broad ultimate divisions.

HALOSACCION RAMENTACEUM, J. G. Ag.

But few specimens of this common species were collected, and none of them were at all equal to New England specimens in luxuriance of growth. The specimens of *Phyllophora membranifolia* mentioned as collected by the Howgate Expedition in the Bulletin of the National Museum, No. 15, are in reality narrow forms of *H. ramentaceum*.

PHYLLOPHORA INTERRUPTA, J. G. Ag.

Fine typical specimens of this species were collected at Point Barrow, but only a single specimen appears in the collection from Ungava Bay.

KALLYMENIA PENNYI, Harv.?

Ungava Bay (Turner, no. 451 and 4873). Two small portions of a *Kallymenia* were among the mounted specimens, and there were besides several much larger specimens in the rough-dried material, some of which bore cystocarpic fruit, so that there can be no doubt of the generic determination. None of the specimens showed any trace of a stipe or a point of attachment. The more perfect were nearly a foot in diameter, and deeply and irregularly lobed at the circumference, the general outline being somewhat oval. Some of the fronds were perforated with a few holes, the largest of which were half an inch in diameter, but the majority were much smaller. The holes were evidently not the result of erosion or decay, but similar to the holes which normally appear in the fronds of certain Algæ. The color was the same as in British specimens of *K. reniformis*, but the thickness of the fronds was somewhat greater than in that species, although it should be added that different authentic specimens of *K. reniformis* vary considerably in thickness.

The present form certainly is not *K. ornata*, P. & R., which has a different color, substance, and habit, and, in spite of the existence of perforations in the frond, I think it must be referred either to *K. reniformis* or *K. Pennyi*. With regard to the last-named species, the descriptions are hardly sufficient to enable one to distinguish it with accuracy, and the question arises whether it may not, after all, be a luxuriant Northern form of *K. reniformis*. *K. Pennyi* was originally found in the Gulf of Cumberland, and in all probability the specimens from Ungava Bay may be referred to the same species, whether

that is really distinct from *K. reniformis* or not. Specimens of *Kalymenia* are among the rarities of the Atlantic coast of America, and the genus is known on the New England coast only from a single specimen collected near Boston by Mr. F. S. Collins. The Ungava Bay specimens are large, and apparently belong to mature plants; but, in the absence of a stipe and a set of younger specimens, the determination may be questioned.

PTILOTA PECTINATA, Kjellm.

Under this name, Kjellman, in his *Algæ of the Arctic Sea*, includes the *Phylota serrata* of Agardh, and the *P. plumosa* var. *serrata* of Kützing, as the type form of the species first described in Gunner's *Flora Norvegica* as *Fucus pectinatus*. A large number of specimens were collected at Ungava Bay, which are identical with the common New England form. There were besides a small number of specimens which may be referred to the variety *integerrima*, Kjellman, *loc. cit.*, Plate XV. fig. 1.

CALLITHAMNION AMERICANUM, Harv.

Ungava Bay (Turner, no. 449, 770, and 820).

CALLITHAMNION PYLAISÆI, Mont.

Ungava Bay (Turner). Gulf of Cumberland (Kumlien).

CALLITHAMNION (ANTITHAMNION) BOREALE, Kjellman, var.
CORALLINA, Kjellman?

A single specimen collected at Ungava Bay may perhaps be referred to this species, but the material was not sufficient to enable me to speak with confidence.

RHODOCHORTON ROTHII, Naeg.

In the account of the *Algæ of the Howgate Expedition* this species is reported from the Gulf of Cumberland. The specimen was sterile, and the determination necessarily doubtful.

DIPLODERMA MINIATUM, Kjellman.

The genus *Diploderma* of Kjellman includes the species of *Porphyra* whose fronds consist of a double layer of cells. Among the rough-dried specimens from Ungava Bay was a large specimen which can with very little doubt be referred to the present species. Naturally, *algæ* of this genus are much injured by resoaking; but, in spite of the unsatisfactory state of the specimens when mounted, a micro-

scopic examination when they were soaked out for preparation showed that the measurements agreed with those of *Porphyra miniata*.

FUCACEÆ.

A few specimens of *Fucus* were collected at Ungava Bay, but they were all sterile and otherwise in too unsatisfactory condition to be determined.

PHÆOSPOREÆ.

LAMINARIA LONGICRURIS, De la Pyl.

A single small specimen from Ungava Bay, with a fragment of another unrecognizable species of the genus, and an imperfect *Alaria*.

AGARUM TURNERI, Post. & Rupr.

Ungava Bay. Several rough-dried specimens.

CHORDA FILUM, Stackh.

Ungava Bay (Turner, no. 485).

DESMARESTIA ACULEATA, Lamour.

Ungava Bay (Turner, no. 507, 535, 4870, and 4872).

CHORDARIA FLAGELLIFORMIS, Müll.

Ungava Bay (Turner, no. 500 and 4870), also collected by the Howgate Expedition.

RALFSIA DEUSTA, J. G. Ag.

Ungava Bay. A single fine specimen four inches in diameter.

DICTYOSIPHON FÆNICULACEUS, Grev.

DICTYOSIPHON FÆNICULACEUS, Grev., var. FLACCIDUS, Aresch.

DICTYOSIPHON HIPPUROIDES, Aresch.?

The species of *Dictyosiphon* are, at the best, difficult of determination, and of the material collected at Ungava Bay it is impossible to speak with certainty, except that some of the few specimens may undoubtedly be named *D. fæniculaceus*. No. 464 is probably the variety *flaccidus*, and no. 475 may be referred with considerable doubt to *D. hippuroides*. Without a larger set of specimens, one could not venture to feel sure of the determination.

PHLÆOSPORA TORTILIS, Aresch.

Kikkerton Islands. Growing on small stones, July, 1878. Abundant (Kumlien). This is an interesting addition to our Arctic flora.

The species is said by Kjellman to have been found at Neuherrnhut, Greenland. It may be expected to occur in the Gulf of St. Lawrence and perhaps in New England, but it has hitherto escaped the notice of our algologists.

CHÆTOPTERIS PLUMOSA, Kütz.

Kikkerton Islands, July, 1878. "Rarely found on shore, and then mostly on kelp. In nine fathoms, head of Gulf of Cumberland, from a crack in the ice, Feb. 24, 1878." (Kumlien.)

SPHACELARIA ARCTICA, Harv.

Gulf of Cumberland (Kumlien).

ECTOCARPUS LITORALIS, Harv.

All the *Ectocarpus* collected at Ungava Bay, as well as those from the Howgate Expedition, belong to the subgenus *Pylaiella*, and are to be included under Kjellman's *Pyl. litoralis*. Among the Howgate Algæ under the name of *Ect. Farlowii* is a form called var. *robustus* of *Ect. litoralis* in the Marine Algæ of New England, and a specimen in poor condition which may possibly be placed in *Ect. Lundsburgii*, Harvey.

CHLOROSPOREÆ.

CLADOPHORA ARCTA, Harv.

Kikkerton Islands, Gulf of Cumberland. "Conspicuously abundant, especially in sandy places." (Kumlien.)

CLADOPHORA GLAUDESCENS, Harv.

Ungava Bay (Turner).

CLADOPHORA GRACILIS, Kütz.?

Ungava Bay. Three specimens, no. 790, 798, and 801, appear to belong to this species, but I am by no means certain.

ULOTHRIX FLACCA, Thuret.

Annanactu Harbor (Kumlien).

MONOSTROMA BLYTHII, Wittrock.

Ungava Bay (Turner). A few fine specimens undoubtedly belonging to this species.